

**Bureau of Reclamation
WaterSMART: Water and Energy Efficiency Grants for FY 2012
Funding Opportunity R12SF80049**

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Republican River Basin Ground and Surface Water Protection Program



Applicant:

**Upper Republican Natural Resources District
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Executive Summary

January 2, 2012

Upper Republican Natural Resources District

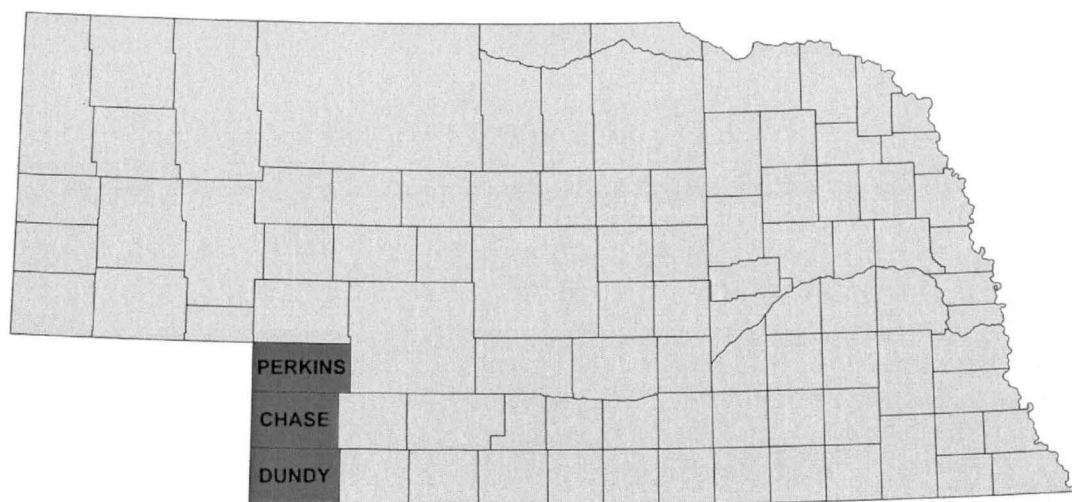
Imperial, Nebraska

Perkins, Chase and Dundy Counties

The Upper Republican Natural Resources District (URNRD) wishes to utilize WaterSMART funds and an equal amount of its own funds to implement soil-moisture probes and related soil-moisture technology to reduce water use in a 1.7 million acre region of southwest Nebraska where irrigated agriculture and associated water challenges are predominant. The requested funds will be used to help defray the cost of the water-saving technology for farmers so use of the technology can gain a stronger foothold in the three-county region of the URNRD, which has water-management and taxing authority in the three counties of Perkins, Chase and Dundy. Use of the technology has the potential to substantially reduce water use in the area.

Reductions will help preserve the underlying High Plains Aquifer and alluvial aquifers, as well as multiple streams in the region that rely upon the aquifers for base flows. Rules and regulations imposed by the URNRD that essentially prohibit the expansion of irrigated acres in the region and aim to reduce overall water consumption in the District will help ensure that implementation of probes will meet the primary WaterSMART program goal of producing quantifiable and sustained water savings.

Upper Republican Natural Resources District Project Area



Background Data

The primary water supply in the URNRD and the foundation of irrigated agriculture in the District is the High Plains Aquifer. Rules and regulations imposed by the URNRD since the late 1970's, including what are believed to be the first limits on agricultural use of groundwater in the country, have successfully slowed declines in the aquifer. Further slowing declines, however, continues to be a primary objective of the URNRD and will need to be accomplished to preserve the aquifer for generations to come. The average, District-wide decline in the water table since 1980 has been approximately 20 feet.

The Ogallala geologic formation underlies all but the extreme southern and northwestern parts of the District. It ranges in thickness from a feathered edge to more than 400 feet. The Ogallala Formation consists of beds of silt, sand, gravel, caliche, and clay, with considerable variability in the character of the formation within short vertical or horizontal distances. These variations are consistent with the fluvial environment in which the Ogallala was deposited. This environment was characterized by a series of braided streams carrying sediment eastward. Some of the sand and gravel deposits are weakly cemented by calcium carbonate into rocks ranging from friable sandstone to relatively hard, ledge-forming mortar beds. Except in a few areas, most notably western Perkins and Chase Counties, the Ogallala Formation is overlain by unconsolidated Quaternary deposits.

The unconsolidated Quaternary deposits, which comprise the land surface of most of the District, consist of sand, gravel, silt, and clay of fluvial origin and sand, silt, and clay carried in by the wind. These deposits range in thickness from a feathered edge to more than 100 feet. These occur as alluvium and terraces in stream valleys and dune sand and loess deposits in upland areas.

The High Plains Aquifer consists of the saturated parts of the Quaternary deposits and the underlying Ogallala Formation. The aquifer is unconfined. In general, the direction of ground-water flow in the District is west to east except in the vicinity of the Republican River. Average ground-water-flow velocities range from less than 50 to more than 200 feet per year.

The White River Group and the Pierre Shale are relatively impermeable in the District, and form the base of the High Plains aquifer. The volume of ground water in storage in the High Plains aquifer is a function of the saturated thickness of the aquifer, the area that aquifer covers, and the porosity of the aquifer. All ground water cannot be withdrawn by dewatering or pumping because some water molecules cling to rock or soil particles due to the surface tension of water. The typical specific-yield value or recoverable, available water for the aquifer is in the

range of 0.18. The saturated thickness of the aquifer within the District ranges from approximately 50 feet to 400 feet.

The surface-water system in the District consists of streams, reservoirs, and one surface water irrigation district, the Pioneer Irrigation District. These components, along with the aquifer system, form a complex hydrogeologic system. The Republican River is the major stream system in the District. The Republican River and the North Fork of the Republican River have several tributaries within the District, including: Stinking Water, Frenchman, and Spring Creeks in Chase County, and Buffalo, Rock, Horse, Spring, Indian, and Muddy Creeks in Dundy County.

Enders Reservoir is the only surface-water impoundment in the District with storage capacity greater than 1,000 acre-feet. Numerous small impoundments also exist. There are no permanent natural lakes in the District. Enders Reservoir, on Frenchman Creek, has an average surface area of 1,242 acres and is used for storing irrigation water. The Pioneer Irrigation District is a surface water appropriator on the North Fork of the Republican River, an interstate stream, in Dundy County. Pioneer holds a water right to 47.39 cubic feet per second (cfs) of water with a priority date of April 4, 1890. The water is diverted into a canal called the Pioneer Ditch, which runs from Yuma County across the state border into Nebraska. Pioneer's right to divert water in Colorado to irrigate Nebraska lands has been memorialized by the Republican River Compact, an interstate agreement between the states of Colorado and Nebraska.

There are approximately 435,000 irrigated acres in the District watered by approximately 3,300 groundwater irrigation wells. Residential and commercial water use in the District is minimal; the total, combined population of Perkins, Chase and Dundy Counties is about 9,000 residents.

The average annual water use by irrigators over the last 30 years, documented and verified by District staff over that time period utilizing flow meters that are required on all irrigation wells, has been 11.9 inches per irrigated acre. The average, annual amount of groundwater applied to crops over the same time period has been about 430,000 acre feet. The predominant irrigated crop in the District is corn, with approximately 300,000 acres of irrigated corn annually planted in the District. Irrigated dry-edible beans and soybeans are the next most common irrigated crops, but the total amount of irrigated acres planted with either of those crops is only about 10 percent of the irrigated-corn total.

The URNRD restricts the amount of groundwater that can be applied using a five-year allocation applied to all irrigators in the District. The current, annualized allocation is 13 acre-inches per year. The URNRD has formally established a goal of reducing water use to an average of 11.4 inches per acre and believes widespread use of soil-moisture probes and associated technology

can help achieve this goal. Utilizing WaterSMART grant funds, the District would be able to both aid the implementation of the technology to produce relatively immediate water savings and, by demonstrating benefits of the technology, encourage District-wide use of the probes to achieve annually increasing rates of water savings. Reduced irrigation in the District through use of the probes could also help save energy by reducing the amount of energy required to operate irrigation pumps, most of which rely upon electric or diesel motors.

Technical Project Description

The use of agronomic technology has the potential to significantly reduce water usage in the District for the benefit of the aquifer, streams that rely upon the aquifer, and the long-term viability of irrigated agriculture in the District. The importance of irrigation in the District extends beyond the District's borders: Two of the three counties in the URNRD, Chase and Perkins, are among the top 4 percent of counties nationally in corn production.

The District intends to implement a cost-share program whereby WaterSMART grant funds would be used to pay for 1/3 of the cost of soil-moisture probe equipment and, if available with products farmers choose to purchase under the program, services to be used by farmers in the District. Funds committed by the URNRD would be used to pay for 1/3 of the equipment and services, and participating producers would be required to pay the remaining 1/3 of the costs.

Requiring producers to pay a portion of the costs will help ensure that participating producers more closely monitor, and actively use, the technology. WaterSMART and URNRD funds would be used to reimburse farmers who purchased qualifying equipment and services. Using this practice instead of applying WaterSMART and URNRD funds to the outright purchase equipment that could then be distributed or sold at reduced costs to qualifying farmers recognizes the array of products now available and will allow farmers to select products and services that best fit their operations.

Qualifying farmers will be those who own irrigated land anywhere within the three counties of Perkins, Chase and Dundy. The URNRD will intensively publicize the program beginning when and if grant funds are awarded, in an effort to implement as many of the soil-moisture probes and related services before the 2012 irrigation season. The irrigation season typically begins in May and peaks in July. The publicity of the program will be achieved with regular use of local and regional media, the District newsletter that is included in all newspapers distributed throughout the entire District, and possibly through letters mailed directly to irrigators in the District by the URNRD. A field day will be held by the URNRD within the first three months of the grant award to demonstrate the use and benefits of soil-moisture probes.

There is a wide range of soil-moisture-detecting technology available and now on the market. Qualifying equipment and services, when applicable, will be that which detects soil moisture at a depth of at least one foot and transmits the information to the producer. Available products exceed this capacity significantly and are able to wirelessly transmit soil-moisture information. Commonly, software packages that accompany the probes and the telemetry provide easy-to-understand information to farmers who are trying to determine whether it is necessary to irrigate at a given time. The information is also often packaged in such a way that a recommendation is essentially provided to the farmer on whether or not to irrigate. Additionally, some products that could be funded under the program include services of agronomists or staff of companies who provide the products who help farmers interpret the information that is provided by the probes.

It is estimated that water savings averaging approximately 2 inches per acre can be achieved without reducing, and in some cases increasing, yields. Product developers estimate this level of savings and farmers in the District who currently use probes estimate that they have reduced per-acre irrigation applications by approximately the same amount. This level of reduction has an economic appeal to farmers because of the costs of pumping water, which are expected to increase in coming years. Another incentive is the URNRD's groundwater pumping restrictions. It is expected farmers will be inclined to use the technology under a cost-share arrangement as a tool to help them stay under the District's pumping limitations. Additionally, use of the probes has been shown to increase yields using the same amount of water as what would have been produced by applying the same amount of water but not using probes by directing farmers to irrigate more efficiently, at periods when applications have the best chance of improving yields.

The URNRD is well positioned to assess results from use of the probes. All irrigation wells in the three-county District are outfitted with flow meters, pursuant to URNRD rules. Flow meters are annually read by URNRD staff in the fall, at the end of irrigation season. The URNRD has approximately 30 years of annual irrigation records on wells in the District. Irrigation applications vary significantly from year-to-year, of course, depending on precipitation and are not solely dependent on more advanced farming practices. However, the District's extensive historical records of well-by-well groundwater pumping and crops grown on individual fields will allow it to compare pumping levels on fields during years of similar precipitation levels when probes were not used, but subsequently were used due to participation in the WaterSMART program. The URNRD intends to follow WaterSMART guidelines that the project be completed in two years by requiring that participating producers purchase the equipment and services within two years of the grant agreement being finalized.

Evaluation Criterion A: Water Conservation, Quantifiable Water Savings

The URNRD estimates a possible, annual water savings of approximately 2,160 acre feet due to use of soil-moisture probes that could be implemented in the District as a result of the proposed partnership with the Bureau under the WaterSMART program. Following is a description of the calculations used to reach this estimate.

The cost of soil-moisture-probe technology that will be available to producers under the program is significantly variable, ranging from approximately \$100 for probes unable to wirelessly transmit moisture data, to approximately \$4,550 for advanced probes, telemetry capabilities, software that interprets moisture data and suggests irrigation scheduling, and related services from agronomists or product experts that help producers use the data.

Given the range of products available and assessing what producers in the region recently have shown a willingness to spend on such technology, \$3,000 is a reasonable estimate of the average cost, per field, of the equipment and services that will be purchased by producers under the proposed cost-share program.

Should the District receive \$100,000 in requested WaterSMART funds, which would trigger the availability of another \$100,000 in URNRD funds, approximately 100 probes could be purchased and used by producers over the two-year project assuming a \$3,000 average cost of the equipment. This number of probes is calculated ($\$200,000 / \$2,000$) using the reasonable estimate that, on average, each probe and related services would cost \$3,000, with URNRD and WaterSMART funds covering a total of 2/3 of the cost of each probe, or \$2,000 of the \$3,000 cost of individual probes and service. Participating farmers would pay the remaining \$1,000 (1/3).

The average irrigated-field size in the District is approximately 130 acres. If 100 probes are purchased under the program, and each one used in a field of 130 acres, approximately 13,000 acres (130×100) would be serviced by probes. If individual probes lead to an irrigation reduction of 2 inches per acre on 13,000 acres, approximately 26,000 acre inches of water ($13,000 \times 2$) will annually be saved, the water remaining in the aquifer or appearing as streamflow. The equivalent of 26,000 acre inches is 2,167 acre feet.

The total, average annual water supply annually available to irrigators in the District for use, subject to a formal plan approved jointly by the State of Nebraska and the URNRD and that the URNRD is actively crafting regulations to ensure is not exceeded, is 425,000 acre feet. Approximately 80 percent of water used for irrigation utilizing center pivot irrigation systems, which comprise nearly all irrigation systems in the District, is considered consumptively used.

The remaining 20 percent is non-consumptive, primarily resulting in aquifer recharge. Using these percentages, 340,000 acre feet of the 425,000 acre-foot target for average, annual use, will be consumptively used in the district.

The 2,160 acre feet the URNRD estimates may be annually saved as a result of the proposed WaterSMART partnership will primarily remain in the underlying High Plains Aquifer. Some of the water may also be expected to appear as stream flow because of the High Plains Aquifer's hydrologic connection to streams in the District. The median, 50-year stream-flow-depletion (SDF) factor of all 3,300 groundwater wells in the District is approximately 25 percent. The SDF is the percentage of pumped water over a defined time period, in this case 50 years, that would have resulted in stream flow had it not been pumped. A well's SDF is highly dependent on its proximity to a stream. Using the 25 percent median SDF in the District and the estimated reduction in irrigation applications of 2,160 acre feet, approximately 540 acre feet of the 2,160 acre feet will appear as stream flow annually, on average. The increase in stream flow as a result of the proposed partnership could vary significantly, depending on the SDF of the individual fields where probes are installed and used.

Subcriterion No. A.1(b): Improved Water Management

The amount of water to better managed due to the program is an estimated 13,000 acre feet annually. If a total of 100 probes are installed on 100 fields with an average size of 130 acres, water use will be managed on 13,000 acres using probes. The District's average, per-acre water use over the past 30 years has been approximately 1 acre foot per acre, per year. Applying that average to the number of acres that have probes, the total, estimated amount of water that will be better managed is 13,000 acre feet (130x100x1).

Thirteen-thousand acre feet represents a little more than 3 percent of the District's total available water supply for use by irrigators of 425,000 acre feet, on average (13,000/425,000).

Subcriterion No. A.2: Percentage of Total Supply

The percentage of the total supply that on an annual basis that will be conserved as a result of the project is approximately .005 percent. This assumes savings of approximately 2,160 acre feet annually, and an annual water supply of 425,000 acre feet (2,160/425,000).

Subcriterion No. B.2: Increasing Energy Efficiency in Water Management

The program could result in a substantial decrease in energy consumption due to a reduction in pumping from high-capacity groundwater wells. The average irrigation pump in the District is operated by a 100 horsepower electric motor. Motor efficiency varies significantly, but the average number of kilowatt hours (kWh) used to pump groundwater in the District can be expected to be approximately 37 kWh per acre inch pumped.

The project has the potential to annually reduce the number of acre inches pumped in the District by 26,000 acre inches. The total reduction in energy use, then, could be reduced by approximately 962,000 kWh (26,000x37 kWh).

Evaluation Criterion E: Other Contributions to Water Supply Sustainability

The project's potential to create significant water savings during the project period and beyond by illustrating the effectiveness of probe use, therefore advancing the implementation of them outside of the two year project period, has multiple benefits for the environment and water users across a relatively large area.

The District, as its name suggests, is part of the Republican River Basin. The Basin begins in eastern Colorado, traverses southern Nebraska, and ends in Kansas. Use of water in the Basin is restricted by a 1943 interstate compact that allocates available Basin water between the three states and that over the past decade has been the source of legal and related disputes over water use. A primary response in Nebraska's portion of the Basin to these disputes has been further attempts to reduce consumptive use of water to both maintain compliance with the compact and to preserve the High Plains Aquifer. The proposed project under the WaterSMART program will aid these efforts, in turn helping the aquifer, future generations of groundwater users in the District, and surface water users outside of the District.

The District has had a moratorium on the drilling of new groundwater wells since 1997 and with very limited exceptions prohibits the initiation of new or expanded uses of water that increase Nebraska's computed beneficial consumptive use of water within the URNRD, as required for Republican River Compact compliance.

The District and State of Nebraska also have a formally, joint-approved objective of reducing existing ground water use within the URNRD by 20 percent from the 1998-2002 baseline

pumping volumes and from the 1998-2002 baseline stream flow depletion figures, as computed through use of the Republican River Compact Administration Ground Water Model. Additionally, the URNRD regularly updates its rules and regulations to encourage reductions in consumptive use of groundwater. Increased use of technology such as the probes that would be installed under the proposed partnership is viewed by the URNRD as a vital part of a comprehensive and holistic effort to reduce consumptive use of water and increase the sustainability of water resources.

The project would also be one part of a larger effort by the URNRD to prevent a severe curtailment, or possibly a shutdown, of surface and groundwater irrigation to help the state maintain compliance with the Compact. Formally approved plans between the state, URNRD and other NRDs in Nebraska's portion of the basin include the option of such curtailments to ensure compact compliance is maintained. Systematic reductions in water use possible with widespread and informed use of water-saving technology such as probes can help lessen the likelihood of sudden, severe curtailments in both surface and groundwater use within, and outside, the District. There is widespread agreement in the Basin that use of probes can help achieve water savings, and one other NRD in Nebraska's portion of the Basin currently has a program in place to encourage their use.

Subcriterion No. F.1: Project Planning

The URNRD has developed and jointly approved with the State of Nebraska an Integrated Management Plan designed to reduce water consumption in the District and that specifies other actions that may be needed for the District to adequately limit its use of water. The plan, among other things, outlines overall pumping targets that should be met. The proposed project will help meet those targets.

A copy of the Integrated Management Plan is attached (Attachment A).

Subcriterion No. F.2: Readiness To Proceed

Following is an estimated project schedule:

Spring 2012: URNRD gets notification of WaterSMART program acceptance from Bureau of Reclamation. URNRD begins publicizing possible availability of funds to help cost-share probes.

Summer 2012: URNRD requests that farmers interested in the program and that lack probes document their irrigation applications.

September 2012: WaterSMART funds made available to reimburse farmers for purchase of probes. URNRD funds also used for reimbursement.

Fall/Winter 2012: URNRD continues to publicize availability of grant funds through individual contacts with farmers and media outlets.

Spring 2013: URNRD conducts field day to demonstrate effectiveness of the technology and generate more interest in its use.

Fall 2013: URNRD documents water use of participating farmers who used probes over irrigation season. Water use compared to previous years with similar precipitation and crops when probes were not used.

Winter 2013: URNRD releases to public results of using probes based on water application comparisons with and without their use.

Spring 2014: URNRD notifies farmers it is the last year to take advantage of cost-share opportunity with WaterSMART and URNRD to purchase probes.

Fall 2014: Deadline to purchase probes that can be reimbursed with URNRD and WaterSMART funds. URNRD documents water use of participating farmers who used probes over irrigation season. Water use compared to previous years with similar precipitation and crops when probes were not used.

Winter 2014: URNRD releases to public results of using probes based on water application comparisons with and without their use.

Subcriterion No. F.3: Performance Measures

Flow meters currently installed on all irrigation systems within the three counties comprising the District will allow URNRD to accurately document water use on every field where probes are installed under the program. Flow meters on the irrigation systems in the fields where probes are installed will be read in October of each of the two project years, and subsequent years.

URNRD staff will pull from its database annual historical pumping records of each participant, beginning with the year 1980. Available, historical precipitation records during the irrigation

season of May-September beginning in 1980 and applicable to the county in which each probe is installed will be collected by URNRD staff. Each participant's average, historical water use during years since 1980 that precipitation from May-September varied no more than 10 percent from project-year precipitation during the same months will be calculated. Only those years in which the same crops were raised that are raised during a project year on a field with a probe will be used.

At the time project-year precipitation data is available, water use on those fields where probes were used will be compared to the average historical water use during years with similar levels of precipitation.

The difference between project-year water use and historical use will be used to determine acre-inches and acre-feet of water saved due to the installation probes and related services.

Environmental Compliance

Following are answers to the 10 questions in the Environmental Compliance section of the grant instructions:

1. No
2. No
3. No
4. The majority of groundwater wells were drilled in the 1970's-1980's.
5. No
6. No
7. No
8. No
9. No
10. No

Required Permits or Approvals

No permits or approvals are needed to install and use soil-moisture probes.

Funding Plan

The URNRD Board of Directors has formally approved a resolution committing \$100,000 of URNRD funds to the project. The same amount of money is also being requested from the WaterSMART program.

The URNRD currently levies a tax of \$10 per irrigated acre in the District that will generate approximately \$4.5 million in occupation tax revenue that can be used to fund the URNRD portion of the cost-share agreement. The URNRD also levies a property tax that generates approximately \$1.146 million in revenue. The URNRD's current budget has adequate funding for the proposed project and other projects designed to reduce consumptive use of water.

Above-described tax revenues have generated the \$100,000 needed to meet URNRD's cost-share obligation under the proposal. All contributions to the project will be monetary.

Summary of non-Federal and Federal funding sources

Funding Sources	Funding Amount
Non-Federal Entities	
1. URNRD	\$100,000
Non-Federal Subtotal	\$100,000
Other Federal Entities - None	
Requested Reclamation Funding	\$100,000
Total Project Funding	\$200,000

Official Resolution

An official resolution from the URNRD Board of Directors providing the requested verifications, including funding obligations, is enclosed in the application materials (Attachment B).

Budget Proposal Format

Note: Because the proposed project is within the current scope of duties of URNRD to reduce water consumption in the District, the URNRD is not requesting that any Reclamation funds be directed to URNRD staff to help manage the program. Likewise, all URNRD contributions to the project will be monetary. Both of these actions are meant to ensure that Reclamation and URNRD funds will be cost-effectively used to install the maximum number of probes and related water-saving technologies possible with available Reclamation and URNRD funds.

Budget Item Description	\$/Unit and Unit	Quantity	Recipient Funding	Reclamation Funding	Total Cost
Salaries	\$0				\$0
Fringe Benefits	\$0				\$0
Travel	\$0				\$0
Equipment					
Soil-Moisture Probes and Services	\$2,000	100	\$100,000	\$100,000	\$200,000
Supplies/Materials	\$0				\$0
Construction	\$0				\$0
Environmental and Regulatory Compliance	\$0				\$0
Total Direct Costs					\$200,000
Total Project Costs					\$200,000

Budget Narrative

As stated in the note above, the URNRD is requesting that Reclamation funds be used only for the direct costs of the probes and services associated with the probes, if such services are offered with qualifying products purchased by participating farmers. No reclamation funds will be used for salaries or wages, fringe benefits, travel, materials and supplies or contractual work. Because there are no environmental or regulatory requirements associated with the installation of probes, it is not necessary to set aside funds for such.

Similarly, none of the \$100,000 in URNRD funds obligated to the project will be used for salaries or wages, fringe benefits, travel, materials and supplies, or contractual work.

Republican River Basin Ground and Surface Water Protection Program

The \$200,000 in combined Reclamation and URNRD funds will only be used to reimburse project participants for the costs of the probes and related services. As stated earlier in the application, participants will be reimbursed for 2/3 of the costs of the probes and services.

Effective
November 1, 2010

Upper Republican NRD

FILE COPY

INTEGRATED MANAGEMENT PLAN
Jointly Developed by the
DEPARTMENT OF NATURAL RESOURCES
and the
UPPER REPUBLICAN NATURAL RESOURCES DISTRICT

I. Authority

This Integrated Management Plan (IMP) was prepared by the Board of Directors for the Upper Republican Natural Resources District (URNRD) and the Nebraska Department of Natural Resources (DNR) in accordance with the Nebraska Ground water Management and Protection Act, *Neb. Rev. Stat. §§ 46-701 to 46-754 (Cum. Supp. 2008)*.

II. Background

Commencing in 1978, the URNRD has adopted and enforced rules and regulations for the purpose of managing the ground water resources within the URNRD. On April 11, 2003, effective May 8, 2003, the URNRD, pursuant to applicable statutory rulemaking procedures and *Neb. Rev. Stat. § 46-739 (Cum. Supp. 2008)*, adopted the *State of Nebraska Upper Republican Natural Resources District Amendments to Rules and Regulations for Ground water Control – Order No. 26* and the *Upper Republican Natural Resources District Technical Manual of Policies and Procedures TM-26* (the “URNRD rules” or “the rules”). In the regular meeting, on July 6, 2004, the URNRD voted to extend Order No. 26 until September 1, 2005. Rule 9A of the Rules provides for a basic allocation of ground water to certified irrigated acres within the URNRD of 72.5 acre-inches for the five (5) year period between January 1, 2003 and December 31, 2007, an annualized allocation of 14.5 acre-inches. Since their adoption, the Rules have prohibited additional allocations for ground water use and additional well permits, except under limited circumstances. In addition, among other things, the rules continued and recodified the URNRD’s practice of allowing ground water users to carryforward the unused portion of their allocation, together with any remaining unused portions of allocations from previous years, into succeeding allocation periods and permitted the URNRD to approve pooling contracts, both in accordance with the URNRD rules.

In 1943 the States of Colorado, Kansas and Nebraska entered into the Republican River Compact (the “Compact”) with the approval of the United States Congress. The Compact provides for the allocation of the “virgin water supply” of the Republican River Basin (the “basin”) between the three states. Following several years of dispute about Nebraska’s consumptive use of water within the basin, Kansas filed an original action in the United States Supreme Court against the States of Nebraska and Colorado in 1998, seeking, among other things, to include ground water in the calculation of the virgin water supply and consumptive use. The United States Supreme Court appointed a Special Master who recommended that the depletions to stream flow from the use of ground water must be included in the virgin water supply and be part of the calculation of each state’s beneficial consumptive use. The United States Supreme Court adopted the Special Master’s recommendation. Subsequent to this determination, the states entered into a Settlement

Agreement resolving the remaining issues in the case. The Settlement Agreement was approved by the United States Supreme Court on May 19, 2003.

Both prior and subsequent to the approval of the Settlement Agreement, the DNR conducted and participated in several meetings with the URNRD, including several public meetings. During the course of those meetings the DNR explained, in order for the State of Nebraska to achieve and maintain compliance with the terms of the Settlement Agreement, it would be necessary to (1) continue the moratorium on new surface water appropriations and new ground water wells, (2) reduce all ground water pumpage from historic levels across the entire basin and (3) further reduce ground water pumping needed to comply with the Compact in water short years, to be accomplished to the extent possible through the use of incentive programs to reduce consumptive use of water. Ground water within the basin is regulated by four Natural Resource Districts: the URNRD, the Middle Republican Natural Resources District (MRNRD) and the Lower Republican Natural Resources District (LRNRD) and the Tri-Basin Natural Resources District (TBNRD) (collectively hereinafter the NRDs). Similar discussions were held between the DNR and each of the NRDs regarding the need (1) to accurately measure actual ground water pumpage and surface water diversions throughout the basin and within each NRD, (2) for the TBNRD to maintain, at sufficient levels to offset depletions to the Republican River caused by ground water pumping within the Republican River Compact area within the TBNRD, the Compact Imported Water Supply that Nebraska receives because of discharges from the “ground water mound”; and, 3) for each of the NRDs other than the TBNRD to reduce its ground water pumping from their 1998-2002 baseline pumping volumes, as defined below.

Since 1978, with adoption of its Order #1, the URNRD has required the metering, data collection and reporting of ground water use, resulting in actual pumping and use data, and has imposed allocations and regulation on ground water users within the URNRD, while the use of wells in the MRNRD and LRNRD were neither reported nor regulated during the same period. In order to estimate pumping in the MRNRD and LRNRD, other methods based on hours of operation using electrical power information and individual pumping rates were used. The DNR has determined the following pumping volumes for the period 1998-2002: 531,763 acre-feet for the URNRD, 309,479 acre-feet for the MRNRD and 242,289 acre-feet for the LRNRD. These pumping volumes are used throughout this IMP and are referenced as the “1998-2002 baseline pumping volumes.” DNR, through the use of the Republican River Compact Administration Ground water Model, has also determined each NRD’s depletions to stream flow for the period 1998-2002 (“1998-2002 baseline depletion”): 74,161 acre-feet for the URNRD, 52,168 acre-feet for the MRNRD and 43,954 acre-feet for the LRNRD. Those depletion numbers have resulted in the following depletion proportions: 44% for the URNRD, 30% for the MRNRD and 26% for the LRNRD. These depletion proportions are used throughout this IMP and are referenced as the “1998-2002 baseline depletion proportions.” The percentage of allowable ground water depletions for each Republican River NRD were based on the proportion of the average ground water depletions caused by ground water pumping within each district that occurred during the base-line period from 1998-2002 as determined by model runs of the Republican River Compact Administration Groundwater Model with ground water pumping in each district alternated, turned off and then turned on.

The URNRD and the DNR adopted an IMP on May 3rd, 2005, that contained ground water rules and regulations for the 2005-2007 period. The IMP provided for a ground water allocation of 13.5 inches per certified acre, continued the pooling of allocations, and the carryforward of unused allocations, among other things. The goal of the 2005 IMP was to reduce water use by 5% from the 1998-2002 baseline. The IMP was updated and revised for 2007 – 2012, with a goal of reducing water use by twenty percent (20%) from the 1998-2002 baseline.

Since that time, efforts have been taken to implement or conduct incentive programs, studies, and research to further our understanding and ability to comply with the Republican River Compact and Settlement. Although the URNRD's allowable depletions to stream flow are limited to 44% of Nebraska's allowable depletions, there were no details in the plan to describe how this would be accomplished. In 2008 Colorado, Kansas, and Nebraska entered into dispute resolution regarding a number of issues, including future compliance. In June 2009 the arbitrator issued a finding that the URNRD IMP may be adequate during years with average and above-average precipitation, but since water-short year measures were not specifically identified, the plan may not be adequate during multiple dry years, an issue addressed in this IMP.

The URNRD and the DNR wish to adopt and implement a revised IMP for the regulation of water resources within the district as required by the laws of the State of Nebraska.

The URNRD has agreed to meet its responsibility under *Neb. Rev. Stat.* §46-715, including meeting the obligations under the Settlement Agreement, by adopting revised rules to implement the IMP with regulations and other augmentation programs sufficient to reduce the URNRD's depletions to stream flow to meet the district's proportional share of the requirements of the Republican River Settlement Agreement. To ensure each NRD within the Republican River Basin will be treated equitably, the DNR has agreed not to approve any plan, unless the plan would restrict the use of water by each NRD to within the allocation granted to it as determined by the 1998-2002 baseline pumping volumes and that each NRD shall be assigned its proportionate share of stream flow depletion as calculated by the 1998-2002 baseline depletion percentages.

The URNRD and the DNR agree that the IMP for the District shall keep the NRD's depletions including credits for stream flow augmentation, as determined by the Republican River Compact Administration (RRCA) ground water model (GWM) and in accordance with the RRCA Accounting Procedures to an amount within 44% of the allowable ground water depletions. Based upon its calculations, the DNR believes that at the time this IMP became effective, a 20% reduction in pumping from the 98-02 baseline would be sufficient without additional stream flow augmentation to keep the District's net depletions within the URNRD's 44% share of the allowable ground water depletions during periods of average precipitation throughout the basin. As described in sections below, during periods of low water supply additional reductions from the 98-02 pumping volume may be necessary.

III. Definitions

A. Allowable Ground water Depletions - the maximum level of depletions to stream flow from ground water pumping within the Nebraska portion of the Republican River Compact area that can be allowed without exceeding the Compact allocation, in any one year.

B. Allowable Ground water Depletions for the URNRD - the depletions to stream flow from ground water pumping in the URNRD that are no greater than 44% of the total allowable ground water depletions.

C. Allowable Stream flow Depletions – the maximum amount of stream flow depletion in the Republican River Basin that can be allowed without violating the Compact.

D. Baseline Depletion Percentages – the annual mean depletions to stream flow in the Republican River Basin caused by surface water and ground water use in the years 1998-2002 inclusive. The baseline depletions are 74,161 acre feet for the URNRD, 52,168 acre feet for the MRNRD, and 43,954 acre feet for the LRNRD. The percentage depletions assigned to the NRDs are: URNRD, 44%; MRNRD, 30%; and LRNRD, 26%.

E. Baseline Pumping Volumes – the annual mean ground water pumping from the period 1998 to 2002. The baseline pumping volumes are 531,763 acre-feet for the URNRD, 309,479 acre-feet for the MRNRD and 242,289 acre-feet for the LRNRD.

F. Compliance Standard – the criteria and controls that will be used to determine whether URNRD's rules, regulations, and other programs are sufficient to meet the goals and objectives of this IMP pertaining to pumping volumes and depletions.

G. Net Depletions – an NRD's ground water depletions less any reduction in stream flow depletions or increase in allocation resulting from stream flow augmentation projects, including surface water leases as determined by the RRCA ground water model and in accordance with the RRCA Accounting Procedures.

H. Compact Call Year – A year in which the Department's forecast procedures outlined in Section X.B.2.b of this IMP indicate the potential for non-compliance if sufficient surface water and ground water controls and/or management actions are not taken. Compact Call Year streamflow administration will be conducted by the Department in a manner consistent with Section X.B.2.d of this IMP. Pursuant to Article VI of the Republican River Compact, diversions into the Courtland Canal for beneficial use in the State of Kansas will not be subject to the Compact Call.

IV. Goals and Objectives

Pursuant to *Neb. Rev. Stat. § 46-715* (Cum. Supp. 2008) the goals and objectives of this IMP must have as a purpose “sustaining a balance between water uses and water supplies so that the economic viability, social and environmental health, safety, and welfare of the river basin ... can be achieved and maintained for both the near term and the long term.” The following goals and objectives are also adopted by the URNRD and the DNR to meet the additional requirements of *Neb. Rev. Stat. §46-715*.

A. Goals:

1. In cooperation with the State of Nebraska and the other NRDs, maintain compliance with the Compact as adopted in 1943 and as implemented in accordance with the Settlement Agreement approved by the United States Supreme Court on May 19, 2003;
2. Ensure that water users within the URNRD assume their share, but only their share, of the responsibility to maintain compliance with the Compact;
3. Provide the URNRD’s share of compliance responsibility and impact be apportioned within the URNRD in an equitable manner and to the extent possible, minimize the adverse economic, social and environmental consequences arising from compliance activities;
4. Protect ground water users whose water wells are dependent on recharge from the river or stream and the surface water appropriators on such river or stream from stream flow depletions caused by surface water uses and ground water uses begun after the date the river basin was designated as fully appropriated; and
5. Reserve any stream flow available from regulation, incentive programs, and purchased or leased surface water and ground water required to maintain Compact compliance from any use that would negate the benefit of such regulations or programs, to the extent allowed by statute and the surface water controls of this IMP.

B. Objectives:

1. Prevent the initiation of new or expanded uses of water, with limited exceptions, that increase Nebraska’s computed beneficial consumptive use of water within the URNRD, as required for Compact compliance and by Nebraska law;
2. Ensure administration of surface water appropriations in the Basin is in accordance with the Compact and Nebraska law and the surface water controls of this IMP;
3. Reduce existing ground water use within the URNRD by 20% from the 1998-2002 baseline pumping volumes under average precipitation conditions so that, when combined with stream flow augmentation and incentive programs, the URNRD’s ground water depletions are maintained within 44% of Nebraska’s allowable ground water depletions as computed through use of the Republican River Compact Administration Ground water Model;

4. Make such additional reductions in ground water use in Compact Call Years as are necessary, after taking into account any reduction in beneficial consumptive use achieved through basin-wide incentive and stream flow augmentation programs, to achieve a reduction in beneficial consumptive use in the URNRD to 44% of Nebraska's the allowable ground water depletions to stream flow above Guide Rock . Compact Call Years will be determined through the procedures outlined in Section IX of this IMP;
5. Cause the reductions in water use required for Compact compliance to be achieved through a combination of regulatory, incentive, and augmentation programs designed to reduce consumptive use. To the extent funds are available, incentive programs will be made available through targeted incentive programs;
6. Cooperate with the DNR to investigate and explore methods to manage the impact of vegetative growth on stream flow: and
7. Develop a program to provide offsets for new consumptive uses of water so that economic development in the district may continue without producing an overall increase in ground water depletions as a result of new uses.

V. Map

The area subject to this IMP is the geographic area within the boundaries of the URNRD, (see Map 1). The Rapid Response Region is shown as a sub-area within the boundaries of the URNRD, (see Map 2).

VI. Ground water Controls

The URNRD will utilize the ground water controls as provided by *NEB.REV.STAT.* §§ 46-715, 46-739 and 46-740 to form the Ground water Controls component of this IMP. The controls that the DNR and URNRD agree are necessary and shall be continued are: 1) ground water allocations and 2) a moratorium on new water wells and irrigated acres as are required by the Final Settlement Stipulation (FSS). In order to provide the URNRD flexibility in addressing compliance, the URNRD may implement a reduction in irrigated acres and incentive programs targeting acres with a higher stream flow depletion factor as alternatives to URNRD-wide reductions in allocation or irrigated acres. The rules shall be set forth in detail and implemented through the URNRD's Rules and Regulations and the provisions of the URNRD's Rules and Regulations shall be sufficient so as to meet the Compliance Standards and Controls set forth below.

In addition to satisfying the compliance standards, the rules and regulations adopted by the URNRD shall contain provisions that adequately ensure that no new ground water uses initiated after July 14, 2004, will adversely impact surface water appropriators or ground water users whose water wells are dependent upon recharge from the stream or river. If the Compliance Standards are met, the URNRD may amend or modify its rules and regulations without the approval of DNR, except for the rules and regulations

pertaining to the satisfaction of the requirements of *NEB.REV.STAT.* §46-715(4)(b) and 46-715(4)(c).

A. Compliance Standards

1. Purpose.

These Compliance Standards are established by DNR and URNRD to assess whether the course of action taken by the URNRD, with the intention of providing their proportionate share of assistance to the State in order for the State to maintain compliance with the FSS and Compact, are sufficient. The action taken by the URNRD shall be evaluated in connection with the action taken by the other NRDs in the Republican River Basin and any other relevant considerations, including the information and data provided by DNR and past action by the NRD.

2. Duration

These Compliance Standards shall be used to assess the action taken by the URNRD. On an annual basis the DNR and URNRD shall reexamine the sufficiency and effectiveness of the Compliance Standards to determine if amendments or modifications are necessary to ensure the State's compliance with the FSS and Compact. Nothing contained herein shall prohibit or preclude any amendment or revision, at anytime, by the DNR and URNRD, when such action is necessary. Further, nothing contained in this subsection shall be construed as eliminating the review of the provisions of this IMP as required by *NEB.REV.STAT.* §46-715.

3. Standards

The URNRD shall adopt and implement rules and regulations which shall ensure that the following standards are met. The standards shall be effected through the procedure described in Section IX - Monitoring and Studies. Section IX specifies a forecast and resulting actions needed at the Guide Rock compliance point (during Water short years) and at the Hardy compliance point. The procedures for determining whether the compliance standards are met will be based on the RRCA Accounting Procedures, the baseline ground water pumping volumes, and the annual forecast as outlined in Section IX. The standards are:

- a. Provide for a minimum of twenty percent (20%) reduction in pumping from the 98-02 pumping volume using a combination of regulation and supplemental programs so that the average ground water pumping volume is no greater than 425,000 acre-feet over the long term. If precipitation is lower than average for any given year, the ground water pumping volume for that year may be above 425,000 acre-feet.
- b. An additional reduction in 98-02 pumping volumes of five percent (5%) during the next five year period shall be accomplished primarily through voluntary incentive programs and other means as determined by the URNRD. The necessity for continuing this annual reduction shall be reevaluated by DNR and the URNRD in 2015.

c. The URNRD's net depletions to stream flow shall be no greater than 44% of the allowable ground water depletions determined in accordance with RRCA Accounting Procedures using the RRCA GWM. The average shall be computed using the annual allowable ground water depletion for the same years as are used to determine the averages for Nebraska's compliance with the FSS.

B. Other Controls and Management Activities

The URNRD and the DNR recognize that the required reductions in water consumption could be accomplished by means other than those adopted in this IMP. The IMP and associated controls may need to be amended in the future to implement any such revisions.

1. During Compact Call Years, the URNRD will seek to implement management actions, including but not limited to, surface water leasing, ground water leasing, augmentation, etc., to ensure compliance with this IMP. These management actions will be implemented through the authorities granted by the Nebraska Ground water Management and Protection Act, *Neb. Rev. Stat.* §§ 46-701 to 46-753. Details of such management actions will be provided to DNR by January 31 of each year for evaluation. If such management actions are insufficient to ensure compliance with this IMP, the URNRD will implement additional ground water controls and regulations to make up for any expected shortfall as identified in the annual forecast and described in Section IX of this IMP. Such additional control will include curtailment of ground water pumping within the Rapid Response Region of the URNRD.
2. When necessary to ensure Compact compliance or during Compact Call Years, the URNRD may set a one year pumping allocation within the District. Such allocation will set the maximum pumping level in that year within any region or sub region.
3. Maintain requirement for metering of all ground water uses according to URNRD standards.
4. Provide for transfers according to URNRD and statutory standards.

VII. Surface Water Controls - Department of Natural Resources

The authority for the surface water component of this IMP is *Neb. Rev. Stat.* §§ 46-715 and 46-716 (Reissue 2004). The surface water controls that will be continued and/or begun by the DNR are as follows:

A. The DNR will do the following additional surface water administration as required by the Settlement Agreement:

1. To provide for regulation of natural flow between Harlan County Lake and Superior-Courtland Diversion Dam, Nebraska will recognize a priority date of February 26, 1948 for Kansas Bostwick Irrigation District, the same priority date as the priority date held by the Nebraska Bostwick Irrigation District's Courtland Canal water right.
 2. When water is needed for diversion at Guide Rock and the projected or actual irrigation supply is less than 130,000 acre-feet of storage available for use from Harlan County Lake as determined by the Bureau of Reclamation using the methodology described in Harlan County Lake Operation Consensus Plan attached as Appendix K to the Settlement Agreement, Nebraska will close junior, and require compliance with senior, natural flow diversions of surface water between Harlan County Lake and Guide Rock.
 3. Nebraska will protect storage water released from Harlan County Lake for delivery at Guide Rock from surface water diversions.
 4. Nebraska, in concert with Kansas and in collaboration with the United States, and in the manner described in Appendix L to the Settlement Agreement, will take actions to minimize the bypass flows at Superior-Courtland Diversion Dam.
- B. Metering of all surface water diversions at the point of diversion from the stream will continue to be required. For surface water canals that are not part of a Bureau of Reclamation project, farm turnouts are required to install and maintain a DNR approved measuring device by the start of the 2005 irrigation season. All measuring devices shall meet the DNR standards for installation, accuracy and maintenance. All appropriators will be monitored to ensure that neither the rate of diversion nor the annual amount diverted exceeds that allowed by the applicable permit or by statute.
- C. The DNR's moratorium on the issuance of new surface water permits was made formal by Order of the Director dated July 14, 2004. Exceptions may be granted by the DNR to the extent permitted by *Neb. Rev. Stat. § 46-714(3)* (Reissue 2004) or to allow issuance of permits for existing reservoirs that currently do not now have such permits. Such reservoirs are limited to those identified through the Settlement Agreement required inventory of reservoirs with over 15 acre-feet capacity.
- D. All proposed transfers of surface water rights shall be subject to the criteria for such transfers as found in *Neb. Rev. Stat. §§ 46-290 to 46-294.04* (Reissue 2004) and related DNR rules or the criteria found in *Neb. Rev. Stat. §§ 46-2,120 to 46-2,130* (Reissue 2004) and related DNR rules.
- E. The DNR completed adjudication of individual appropriators in the Republican River Basin upstream of Guide Rock in 2004. The results of that adjudication provided up-to-date records of the number and location of acres irrigated with surface water by such appropriators. Those records shall be used by the DNR to monitor use of surface water and to make sure that unauthorized irrigation is not occurring. The DNR will also be proactive in initiating subsequent

adjudications whenever information available to the DNR indicates the need for adjudication as outlined by state statutes.

F. During Compact Call Years, as determined from the procedures and analysis set forth in Section IX below, DNR will regulate and administer surface water in the basin as necessary to ensure Compact compliance. During Compact Call Years, DNR will issue a "Compact Call" on the Republican River at Hardy or Guide Rock to carry out administration for the Compact in a manner consistent with the doctrine of prior appropriation. A "Compact Call" will result in DNR issuing closing notices on all natural flow and storage permits in the basin until such time as DNR, in consultation with the URNRD and other basin NRDs, determines that yearly administration is no longer needed to ensure Compact compliance, pursuant to Section IX.

VIII. Augmentation and Incentive Programs

The URNRD and the DNR intend to establish and implement financial, incentive, and qualified projects as described in *Neb. Rev. Stat. §§ 2-3226.04, LB 862 (2010)*, *Neb. Rev. Stat. §§ 2-3252* or other incentive programs to reduce beneficial consumptive use of water within the URNRD. These projects include, but are not limited to (1) acquisition by purchase or lease of surface water or ground water rights, including storage water rights with respect to a river or any of its tributaries, (2) acquisition by purchase or lease or the administration and management, pursuant to mutual agreement, of canals and other works, including reservoirs, constructed for irrigation from a river or any of its tributaries, (3) vegetation management, including, but not limited to, the removal of invasive species in or near a river or any of its tributaries, and (4) the augmentation of river flows. As a condition for participation in an incentive program, water users, landowners or the URNRD may be required to enter into and perform such agreements or covenants concerning the use of land or water as are necessary to produce the benefits for which the incentive program is established. Such incentive programs may include, but shall not be limited to, any program authorized by state law and/or federal programs operated by the United States Department of Agriculture.

Any water savings generated through conservation programs, including acreage retirement or other conservation incentive programs undertaken through programs available throughout the Republican River Basin with the use of funds distributed by the State of Nebraska or the United States Government will not accrue to any specific NRD, regardless of the location or other conditions of the acreage included in the program or of the location of the effect of such water savings on the river system. Any water savings resulting from any such basin-wide programs shall be considered in the calculation of each NRD's depletions allocated to each of the NRDs based upon the 1998-2002 baseline depletion proportions.

However, should any NRD establish, fund, and implement its own such conservation program within its NRD's boundaries, the accounting of credit for the resulting water savings shall be given exclusively to that NRD. Any credit resulting from an inter-district conservation program shall be credited as agreed to by the NRDs involved. Also, if multiple NRDs cooperate in a stream flow augmentation project, the benefits shall be provided to each NRD based upon their share of the cost of the program.

To the extent possible, it is the intent of the URNRD to provide compensation to water users that are required to forgo water use to allow the URNRD and the State to comply with the compact. This may be in addition to or as part of any other URNRD incentive or retirement program developed to facilitate compact compliance.

IX. Monitoring and Studies

The overarching purpose of the Monitoring and Studies Section is to ensure that, in cooperation with the other Republican River Basin NRDs, the DNR and URNRD maintain compliance with the Republican River Compact as adopted in 1943 and as implemented in accordance with the FSS approved by the United States Supreme Court on May 19, 2003. The objective of the Monitoring and Studies Section of this IMP is to gather and evaluate data, information, and methodologies that could be used to increase understanding of the surface water and hydrologically connected ground water system; to test the validity of the conclusions and information upon which this IMP is based; and to assist decision makers in properly managing the water resources within the URNRD and the Republican River Basin as a whole.

On an annual basis the results of monitoring and studies will typically be discussed in a basin-wide meeting which will take place prior to October 31 each year. The purpose of the meeting will be to discuss the preliminary accounting for the current year, the forecast of allowable stream flow depletions for the coming year, and potential management actions as necessary. Table 1 outlines important dates and objectives related to section IX.

Table 1. Important Dates and Objectives

Date	Objective
Prior to February 1	URNRD will provide DNR with meter reading database and GIS coverage maps to be used for the RRCA annual model update.
Prior to RRCA Annual Meeting	DNR will provide URNRD with their determination of whether the URNRD was in compliance with the compliance standards based on each previous year's annual Compact accounting.
September - October	Obtain power records and other estimates to determine pumping for T=0 ground water model run.
Prior to October 31	Discuss results of monitoring and studies, preliminary accounting for current year, and early forecast of allowable stream flow depletions.
Prior to November 15	DNR will provide correspondence to URNRD notifying them of potential Compact Call Year determination for the coming year (T+1).
November 15 – January 1	URNRD and DNR will discuss potential management alternatives in the situation that the coming year (T+1) will be a Compact Call Year.
Prior to January 1	Provide final forecast of allowable stream flow depletions and determination of Compact Call Years.
Prior to January 31	URNRD will provide DNR with details regarding existing management alternatives in lieu of additional ground water regulations or controls to make up for the expected shortfall.

A. Plan to Gather and Evaluate Data, Information and Methodologies

As outlined in *Neb. Rev. Stat.* §§ 46-715(2)(e) ongoing programs and new studies or other projects may become a source of information that is used to evaluate the effectiveness of controls

adopted by the by the URNRD and the DNR. The DNR and the URNRD will jointly pursue and/or evaluate studies, contingent upon budget and staff resources, to evaluate their potential effectiveness in achieving the goals and objectives of this IMP.

The following potential studies have been identified by the DNR and the URNRD: (1) crop rotation; (2) vegetation management; (3) irrigation scheduling; (4) a survey of the type and location of irrigation systems throughout the URNRD; (5) tillage practices; and (6) conjunctive management.

B. Monitoring

Part One of the Monitoring Section describes the tracking and reporting of water use activities within fully appropriated areas of the district by the URNRD and the DNR. Part Two of the Monitoring Section describes the analyses that will be utilized to annually forecast the projected depletions in each subsequent year. This accounting and the forecast in accordance with *Neb. Rev. Stat.* § 46-715(6) will serve to increase the understanding and test the validity of the conclusions and information upon which this plan is based.

Compact accounting and data exchanges among the states shall be done annually in accordance with the FSS, dated December 15, 2002, including the Republican River Compact Administration (RRCA) Accounting Procedures and Reporting Requirements which are contained in Appendix C thereof. An annual report of the RRCA is published each year. The accounting procedures, reporting requirements, and annual report of the RRCA are independent of this monitoring plan, and therefore not restated within the Monitoring Section of this plan.

1. Part One: Tracking and Reporting of Water Use Activities

The URNRD and the DNR will make all documents, reports, records, computer runs or other calculations or material necessary to determine compliance with the Compact available to each other, regardless of whether such documents are available under the Nebraska Public Records Act or otherwise, unless such materials are identified as confidential under Nebraska statutes or by a ruling of a court of competent jurisdiction. Specifically, and without limitation, the URNRD agrees to annually provide GIS coverage maps of all lands irrigated and to meter, record and provide to the DNR its ground water usage records and irrigation system details. The URNRD shall make copies of district actions taken on variances, offsets, and similar actions available to DNR.

The DNR agrees to make available to the URNRD all reports and records of the other NRDs necessary to determine their compliance with reductions, as well as all documentation and reports utilized by the DNR to determine the basin's virgin water supplies and Nebraska's compliance with the Compact.

In the event any materials are withheld by either DNR or URNRD under a claim of statutory confidentiality, the party withholding such materials shall describe the contents of the materials and reasons for the denial in accordance with *Neb. Rev. Stat.* § 84-712.04.

2. Part Two: Forecast Procedures

Each year in compliance with *Neb. Rev. Stat. § 46-715(6)* the DNR in consultation with the Republican River NRDs shall forecast the maximum amount of water that may be available from stream flow for beneficial use in the short term and long term to comply with the Compact. This forecast will be used to assist the DNR and the NRDs in ensuring compliance with the Compact. DNR in conjunction with the NRDs will annually evaluate the forecast procedures and make changes as deemed necessary to reflect management actions being taken in the basin.

In order to complete the forecast, the DNR and URNRD in conjunction with the other NRDs will review available information and determine if additional controls must be implemented within any district for Compact Call Year compliance. The forecast will be completed prior to January 1 of each year, and will detail the expected shortfall within each district in the event that the coming year is a Compact Call Year. By the following January 31, if necessary, the URNRD will provide DNR with details regarding existing management alternatives (such as execution of existing surface water leases) in lieu of additional ground water regulations or controls to make up for the expected shortfall.

The procedures developed to complete the forecast will be reviewed annually by the DNR to determine if modifications are necessary. The forecast will project the next year's balance (projected Nebraska allocation plus projected Imported Water Supply less the projected Computed Beneficial Consumptive Use, or CBCU), and the projected water short year and normal year accounting balances. These balances will be utilized in conjunction with other information to determine if a Compact Call Year exists.

The DNR's calculation of allowable ground water depletions for the URNRD and determination of the necessity for additional controls will utilize additional ground water model information, estimated end-of-year information for reservoir volumes, and estimated stream flow to determine on an annual basis whether additional NRD-specific controls must be implemented.

a. Determination of Available Stream Flow

The forecast will typically determine the forecast values for both Guide Rock (water short year accounting point) and Hardy (normal year accounting point). The DNR's forecast values for Guide Rock will include: 1) the one-year balance (projected allocation less the projected CBCU plus the imported water supply); two-year average, and three-year average. The DNR's forecast values for Hardy will include: 1) the one-year balance (projected allocation less the projected CBCU plus the imported water supply); and 2) the five-year average. These forecasted values will be used in conjunction with sections IX.B.2.b, IX.B.2.c, IX.B.2.d and IX.B.2.e to determine when management actions or controls must be implemented. The DNR will calculate forecast values for the next year using the variables in table 2:

Table 2. Information Used for 2010 Forecast of Allowable Depletions.

Year	Item	Information Source
T - 3		Draft; current Accounting Procedures (v. 2005)
T - 2		Draft; current Accounting Procedures (v. 2005)
T - 1		Draft; current Accounting Procedures (v. 2005)
Provisional Data for T = 0 (Current Year or Immediate Past Irrigation Season)	Pumping	Power records estimate
	Surface Water Use	Estimated from preliminary data and previous years values
	Stream Flow	Available provisional records end of year estimated
	Evaporation	T - 1 records
Forecast Year T + 1 (Coming Irrigation Season)	Ground water Consumptive Use and Imported Water Supply Credit	Average values for T = 0 and T - 1
	Surface Water Consumptive Use	Colorado: Average of T - 1 and T - 2 use Kansas: + (.1858 x HCL content) + 9,575 Nebraska: - (4x10 ⁻⁷) x (NE lake volume) ² + (0.52) x (NE lake volume) - 42,000
	Stream Flow	+ (5-year average of state line flows) x 0.41 + 0.23 x HCL content - 27,450

In accordance with *Neb. Rev. Stat. § 46-703(6)*, DNR, NRDs, and surface water project sponsors shall meet prior to the final forecast of allowable stream flow depletions and determination of Compact Call Years. At this meeting the involved parties will discuss the forecasted streamflow and surface water consumptive use. From these discussions, surface water project sponsors may present a plan to DNR to achieve a consumptive use that is less than forecasted consumptive use. Such a plan could allow surface water project sponsors to avoid a potential Compact Call Year. This plan must be completed and provided to the Department no later than December 1 of the current year (T=0).

The following equations will be utilized to determine the one year balance for the forecast year.

$$\begin{aligned} \text{CWS} = & + \text{SwCBCU}_{\text{NE}} + \text{SwCBCU}_{\text{KS}} + \text{SwCBCU}_{\text{CO}} \\ & + \text{GwCBCU}_{\text{NE}} + \text{GwCBCU}_{\text{KS}} + \text{GwCBCU}_{\text{CO}} \\ & + \text{Stateline Stream flow} \end{aligned}$$

$$\text{Nebraska Allocation} = \text{CWS} * 0.5$$

$$\text{CBCU}_{\text{NE}} = \text{SwCBCU}_{\text{NE}} + \text{GwCBCU}_{\text{NE}}$$

IWS = Imported Water Supply Credit

Hardy One Year Balance = Nebraska Allocation + IWS – $CBCU_{NE}$

Guide Rock One Year Balance = Hardy One Year Balance * 0.89 – 9040

Where:

T-3 = Three years ago from the current year

T-2 = Two years ago from the current year

T-1 = One year ago from the current year

T=0 = The current year

T+1 = The upcoming year that is being forecasted

CWS = Computed Water Supply

$GW\ CBCU_{NE, KS, CO}$ = Ground water Computed Beneficial Consumptive Use for each respective state

$SW\ CBCU_{NE, KS, CO}$ = Surface Water Computed Beneficial Consumptive Use for each respective state

Nebraska Allocation = CWS x 0.5: The amount of water the State of Nebraska is allowed to use over one year

Balance = The sum of Nebraska's Allocation, plus the Nebraska Imported Water Supply, less Nebraska's Computed Beneficial Consumptive Use

The one year balance for normal year accounting (Hardy One Year Balance) and water short year accounting (Guide Rock One Year Balance) will be utilized to project the two-year and three-year average balances above Guide Rock and the five-year average balance above Hardy.

b. Compact Call Year Evaluation

This section of the monitoring plan specifies the process that will be completed by the DNR to determine the Compact Call Years, as detailed in Attachment 1, Republican River Water Supply Evaluation and Required Actions Flowchart. This evaluation takes into account reservoir content and recent balances above Guide Rock and Hardy and the annual forecast as described above in Section IX.B.2.a. This process will be completed and provided to the URNRD by DNR prior to January 1 of each year.

Checklist A. Water short year Test

- 1) Is the forecast projection for the coming year's irrigation supply less than 119 kAF?
 - a. Yes. Proceed to Checklist B.
 - b. No. Proceed to Checklist C.

Checklist B. Water short year

- 1) Is the current year's balance ($T = 0$) above Guide Rock sufficient to offset the dry year forecast for next year's balance above Guide Rock minus 10 kAF¹?
 - a. Yes. Proceed to Checklist D.
 - b. No. COMPACT CALL YEAR: The DNR will determine each NRD's share of any potential overuse and propose adjustments in accordance to Section IX.B.2.c. of this IMP.

Note: If it is beneficial to utilize the alternative water short year provisions from the FSS (the previous two years have a greater balance than last year alone), and an alternative water short year plan has been approved by the RRCA, then the two-year balance (for $T = 0$, the current year, and the prior year, $T - 1$) will be substituted for the current year's balance in Checklist B.

Checklist C. Early Warning System for Water short year Compliance

- 1) When Harlan County Lake declines from one year to the next, the December end-of-month (EOM) content is generally about 84% of what it was last year. A December EOM of 246 kAF provides a high level of confidence that the coming year ($T+1$) will not be water short. Based on the current year's ($T=0$) Harlan County Lake December EOM content, compute a dry-year projection for next year ($T+1$) based on this relationship. Is the value greater than 246 kAF?
 - a. Yes. Proceed to Checklist D.
 - b. No. Advance to question 2.
- 2) Is the dry year forecast for next year's ($T+1$) balance above Guide Rock greater than zero?
 - a. Yes. Proceed to Checklist D.
 - b. No. Advance to question 3.
- 3) Is the current year's balance ($T = 0$) above Guide Rock sufficient to offset the dry year forecast for next year's balance ($T + 1$) above Guide Rock minus 10 kAF²?
 - a. Yes. Proceed to Checklist D.

¹ In the event it is the second consecutive Compact Call Year, this value will be reduced to 5kAF. For any remaining consecutive Compact Call Years, it will be reduced to zero.

² In the event it is the second consecutive Compact Call Year, this value will be reduced to 5kAF. For any remaining consecutive Compact Call Years, it will be reduced to zero.

- b. No. COMPACT CALL YEAR: The DNR will determine each NRD's share of any potential overuse and propose adjustments in accordance to Section IX.B.2.c. of this IMP.

Checklist D. Normal Year Administration

- 1) Will the forecast for next year ($T + 1$) result in a 5-year balance at Hardy that is greater than 50 kAF?
 - a. Yes. Analyze long term trends and additional adjustments in accordance to Section IX.B.2.e
 - b. No. Advance to question 2.
- 2) Will both the forecast for next year result in a 5 year balance at Hardy ($T - 3$, $T - 2$, $T - 1$, $T = 0$, and $T + 1$) that is greater than zero and the balance at Hardy of the most recent four years ($T - 2$, $T - 1$, $T = 0$, and $T + 1$) be greater than zero?
 - a. Yes. Analyze long term trends and additional adjustments in accordance to Section IX.B.2.e
 - b. No. COMPACT CALL YEAR: The DNR will determine each NRD's share of any potential overuse and propose adjustments in accordance to Section IX.B.2.c. of this IMP.

c. Calculation of Allowable Ground water Depletions for the URNRD and Determining the necessity of Additional Controls

This section of the monitoring plan specifies the calculations which will be completed by the DNR to determine the allowable ground water depletions for the URNRD in any Compact Call Year. These procedures will be utilized to indicate when additional controls must be implemented by the URNRD and DNR to ensure compliance with this IMP in the event that the DNR's forecast, provided prior to January 1 of each year, indicates a Compact Call Year. These procedures will incorporate information provided by the URNRD (contracts for water leasing, augmentation, etc.) to the DNR by January 31 of each year following a forecast that indicates a Compact Call Year. When such Compact Call Year is indicated, the DNR will implement additional surface water controls (Section VII.F of this IMP). The procedures for determining the allowable ground water depletion for the URNRD are as follows.

The Allowable ground water depletion for the URNRD =
 $(\text{Nebraska Allocation} + \text{IWS} - \text{SWCBCU}_{\text{NE}} - \text{Other NRD CBCU}) * 0.44$

Where:

Nebraska Allocation = Nebraska available water supply under the Compact

IWS = Imported Water Supply credit

$SWCBCU_{NE}$ = The surface water consumptive use by Nebraska, includes net evaporative losses

Other NRD CBCU = The $GWBCU_{NE}$ calculated for the South Platte NRD, Twin Platte NRD, Tri-Basin NRD, Central Platte NRD, and Little Blue NRD

The DNR will utilize information provided by the URNRD by January 31, to evaluate the following.

Step 1. URNRD Estimated Ground water Depletions

Ground water depletions for the URNRD will be based on the previous 2-year average (as described in Table 2 above), unless such plan provided by the URNRD indicates that additional restrictions on groundwater pumping will be imposed. If the additional restrictions would limit the pumping to be less than the previous two year average then the lower estimate will be used. In cases where that year's allocation will be less the URNRD will provide the DNR a map indicating the geographic area subject to the allocation for that year and the maximum allocation available. The DNR will utilize the information provided by the URNRD and represent such information in the RRCA GWM.

Step 2. Potential yield from URNRD surface water leases/agreements, augmentation, etc.

The DNR will determine the potential yield from any surface water lease/agreement, augmentation, etc. entered into or provided by the URNRD. In the event that augmentation is utilized, procedures for determining the project yield must have been approved by the RRCA. This potential yield will be incorporated as NRD management actions in section IX.B.2.d.

If a Compact Call Year is reached as a result of checklist B1 or C3 the final step to determine if additional ground water and surface water controls (refer to Section VI.B.1. and VII.F of this IMP) must be implemented is as follows.

Allowable ground water depletions for URNRD (as determined above) - Forecasted URNRD's portion of $GWBCU_{NE}$ (Step 1) + Potential yield from URNRD surface water leases/agreements, augmentation, etc. (Step 2) + Current Year's Balance ($T = 0$) - 3333³.

If the resulting balance is greater than or equal to negative one hundred (-100) ac-ft, no additional ground water and surface water controls will be implemented.

³ In the event it is the second consecutive Compact Call Year, this value will be reduced to 1667. For any remaining consecutive Compact Call Years, it will be reduced to zero.

If the resulting balance is less than negative one hundred (-100) ac-ft, the additional ground water and surface water controls (refer to Section VI.B.1. and VII.F of this IMP) must be implemented. This potential yield will be incorporated as NRD management actions in section IX.B.2.d.

Note: If it is beneficial to utilize the alternative water short year provisions from the FSS (the previous two years have a greater balance than last year alone), and an alternative water short year plan has been approved by the RRCA, then the two-year balance (for $T = 0$, the current year, and the prior year, $T - 1$) will be substituted for the current year's balance in Checklist B.

If a Compact Call Year is reached as a result of checklist D2 the final step to determine if additional ground water and surface water controls (refer to Section VI.B.1. and VII.F of this IMP) must be implemented is as follows.

Allowable ground water depletions for URNRD (as determined above) - Forecasted URNRD's portion of GWCBCU_{NE} (Step 1) + Potential yield from URNRD surface water leases/agreements, augmentation, etc. (Step 2) + Previous Years Balances ($T = -3$, $T = -2$, $T = -1$, $T = 0$ or if applicable + $T = -2$, $T = -1$, $T = 0$).

If the resulting balance is greater than or equal to negative one hundred (-100) ac-ft, no additional ground water and surface water controls will be implemented.

If the resulting balance is less than negative one hundred (-100) ac-ft, the additional ground water and surface water controls (refer to Section VI.B.1. and VII.F of this IMP) must be implemented. This potential yield will be incorporated as NRD management actions in section IX.B.2.d.

d. Calculation of Compact Call Stream flow Volume

This section of the monitoring plan specifies the calculation which will be completed by the DNR to determine the stream flow volume necessary to ensure Compact compliance in any Compact Call Year. These procedures will be utilized to indicate when additional controls must be implemented by the URNRD and DNR to ensure compliance with this IMP in the event that the DNR's forecast, provided prior to January 1 of each year, indicates a Compact Call Year. These procedures will incorporate information provided by the URNRD (contracts for water leasing, augmentation, etc.) to the DNR by January 31 of each year following a forecast that indicates a Compact Call Year. When such Compact Call Year is indicated, the DNR will implement additional surface water controls (Section VII.F of this IMP). Criteria that will be used to determine when administration for the "Compact Call" is no longer necessary will be based on ensuring sufficient stream flow volumes have been achieved at the compliance point. Determination of sufficient stream flow volumes to ensure Compact compliance will be determined through the following procedures.

Compact Call Stream flow Volume = Forecasted Stream flow + NRD Management Actions + Surface Water Curtailment Benefit

Where:

Forecasted Stream flow = Stream flow for T+1; (5-year average of state line flows) x 0.41 + 0.23 x HCL content – 27,450.

NRD Management Actions = Actions taken by the URNRD and/or other basin NRDs to enhance stream flow. These actions may include surface water or ground water leases, augmentation, or curtailment.

Surface Water Curtailment Benefit = Actions taken by DNR to ensure compact compliance in the event that Basin NRD Management Actions are not sufficient to overcome the projected negative balance.

e. Additional adjustments related to long-term trends

The DNR and URNRD in conjunction with the other basin NRDs will annually meet to consult to determine if additional reductions from the 98-02 pumping volumes may be warranted. Through this consultation, the DNR and URNRD will review expected long term (5-20 years) increases in depletions to stream flow and discuss potential mitigation measures that may be necessary.

f. Harlan County Lake Operations

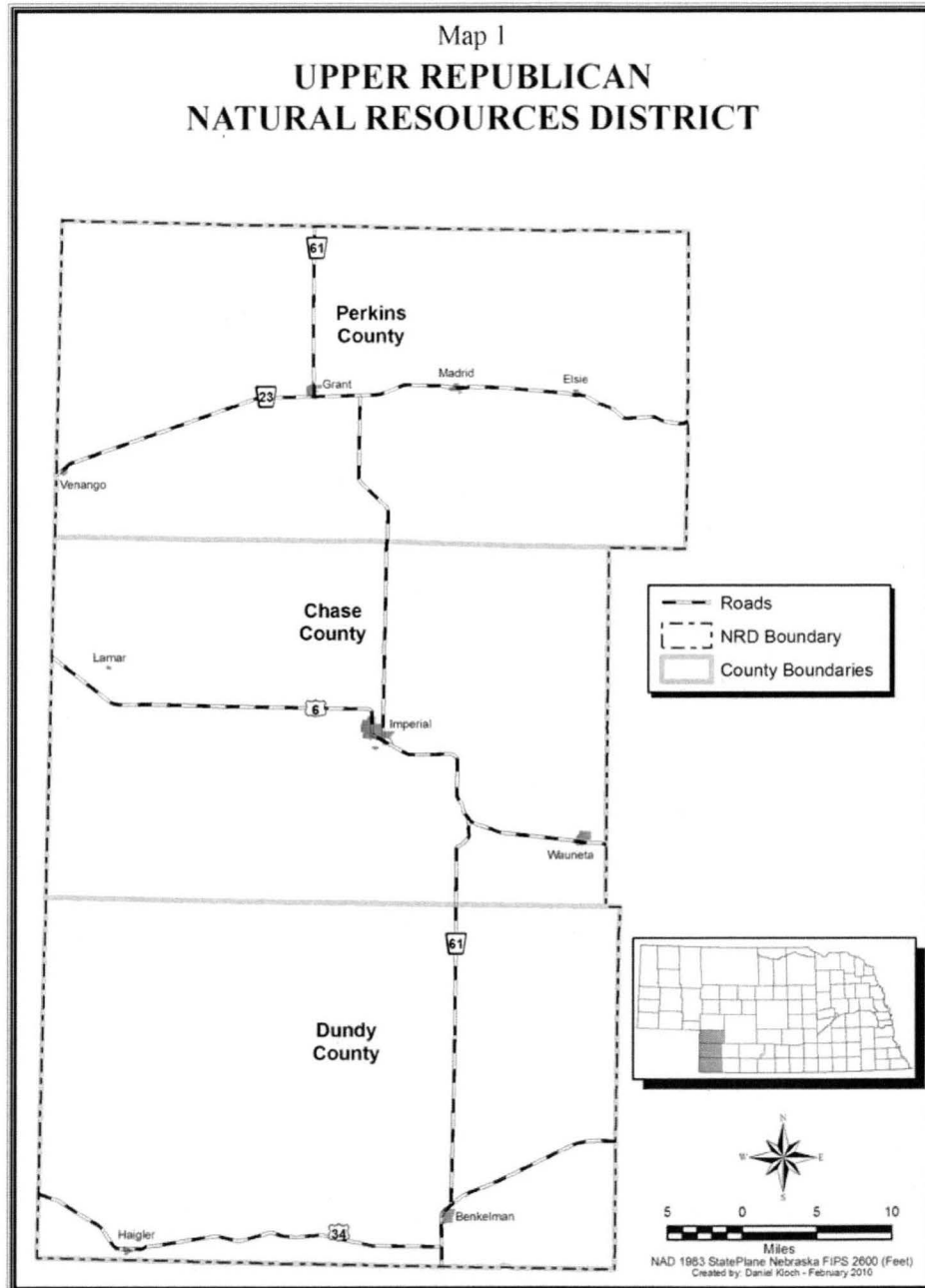
In the event that operations of Harlan County Lake are not in accordance with Appendix K of the Final Settlement Stipulation, the DNR will work in consultation with the NRDs to modify Sections VI, VII, and IX of this IMP until normal operations resume.

X. INFORMATION CONSIDERED

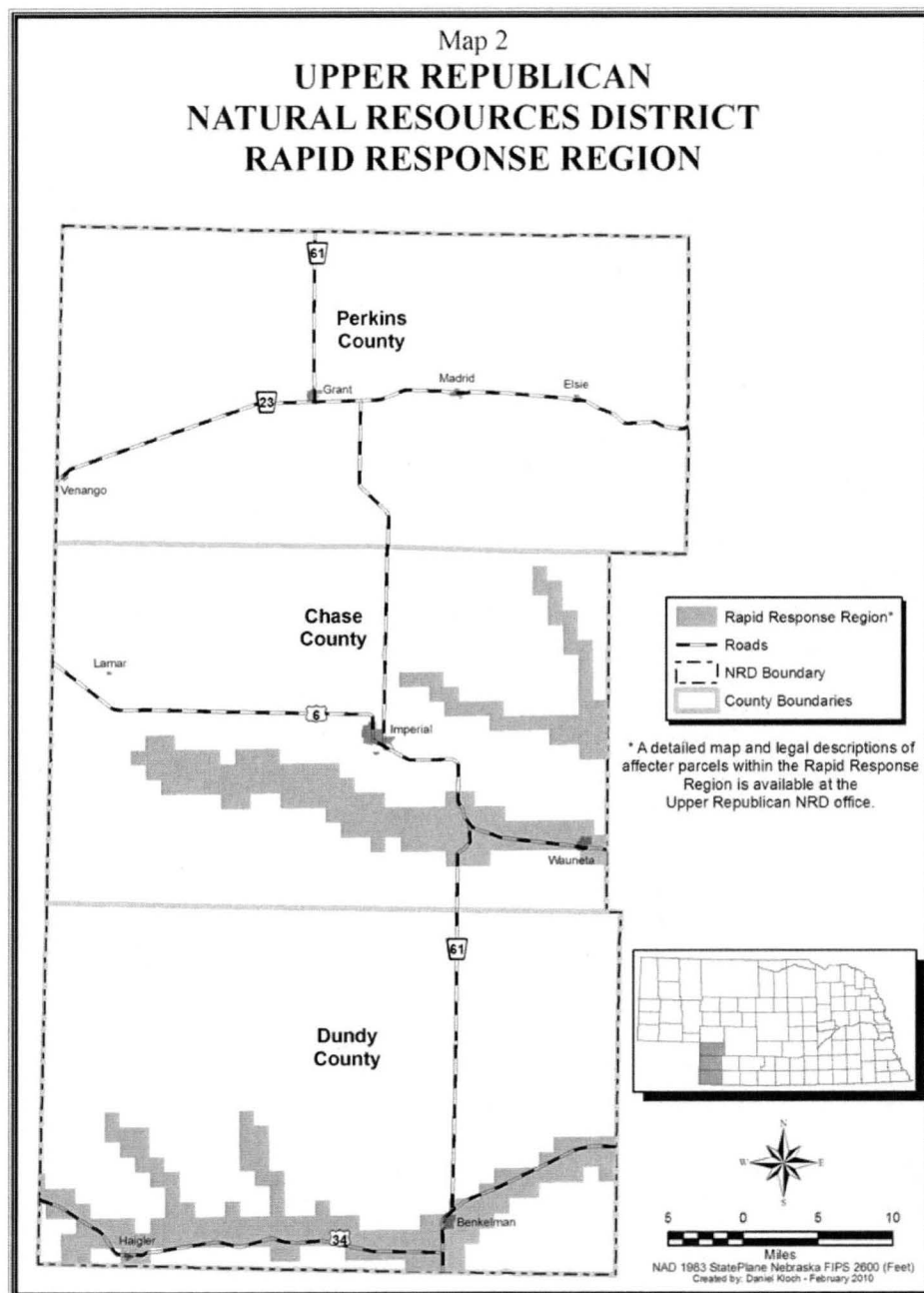
Information used in the preparation and to be used in the implementation of this IMP can be found in:

- Simulation runs of the Republican River Compact Administration Ground water Model,
- The formulae and data compliance tables of the Final Settlement Stipulation for the Compact,
- The URNRD's Rules,
- The URNRD's Ground water Management Plan,
- Arbitrator's Final Decision, Karl Dreher, June 30, 2009, and
- Additional data on file with the URNRD and the DNR.
- Nebraska statutes and case law.

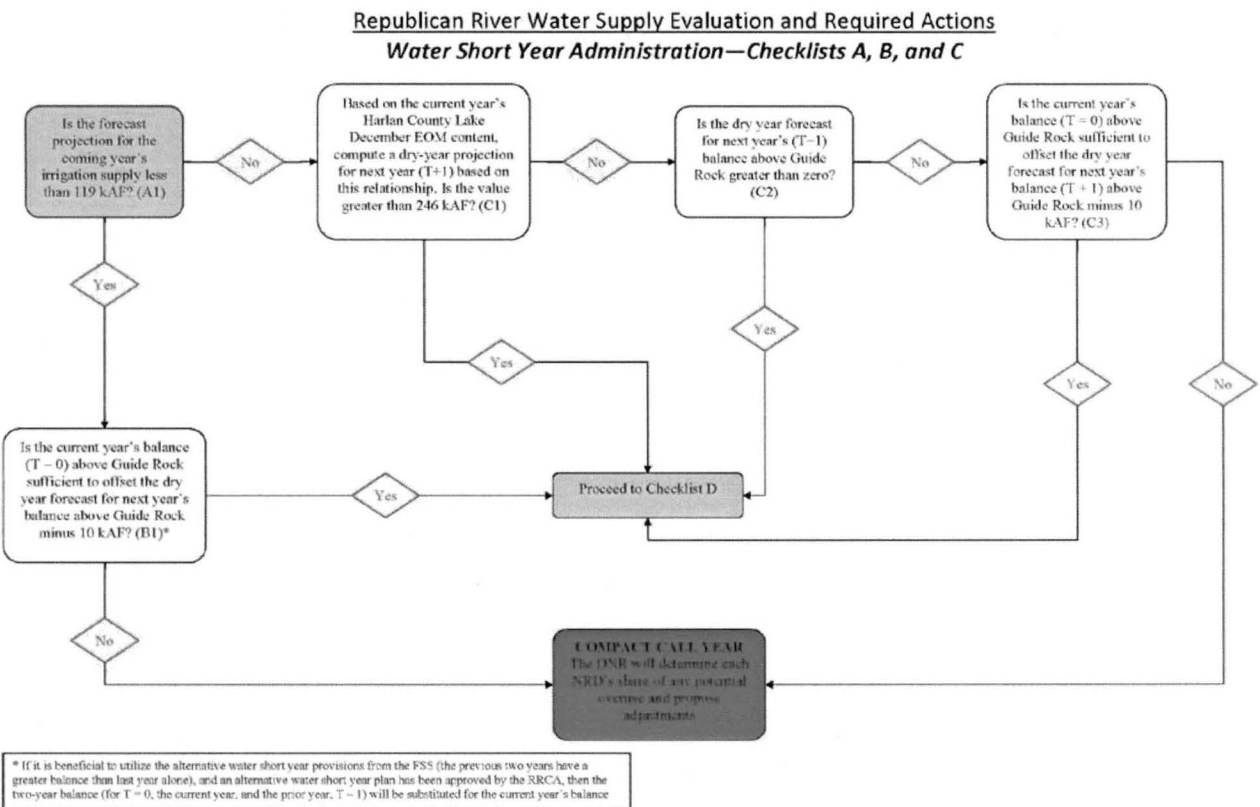
MAP 1. Upper Republican Natural Resource District



MAP 2. Upper Republican Natural Resource District Rapid Response Region

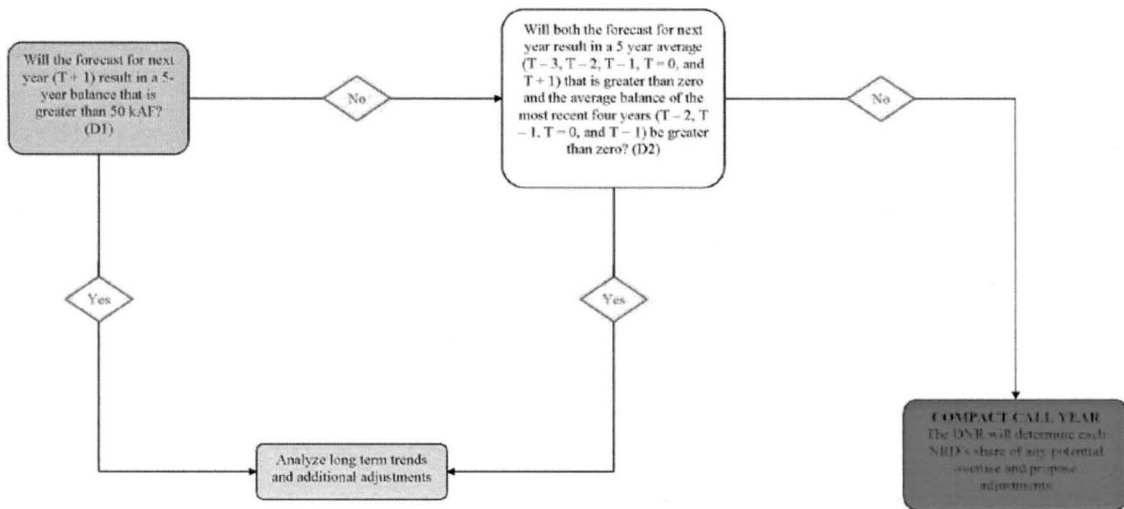


ATTACHMENT 1. Republican River Water Supply Evaluation and Required Actions



August 5, 2010

Republican River Water Supply Evaluation and Required Actions
Normal Year Administration—Checklist D



August 5, 2010

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RESOLUTION OF THE UPPER REPUBLICAN NATURAL RESOURCES DISTRICT

Resolution No. UR-2012-1-12-01

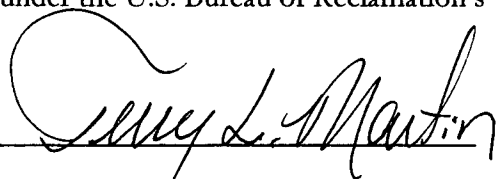
WHEREAS, the Board of Directors agrees that the General Manager or Assistant Managers of the Upper Republican Natural Resources District have legal authority to enter into an agreement with the U.S. Bureau of Reclamation to execute provisions of the WaterSMART Grant program; and

WHEREAS, Management of the Upper Republican Natural Resources District has reviewed and supports the application for WaterSMART Grant funds; and

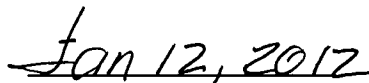
WHEREAS, the Upper Republican Natural Resources District is a political subdivision of the State of Nebraska and as such has taxing authorities and current budgetary capabilities sufficient to provide the amount of funding, \$100,000, specified in the WaterSMART Grant application funding plan; and

WHEREAS, the Upper Republican Natural Resources District agrees to work with the U.S. Bureau of Reclamation to meet established deadlines for entering into a cooperative agreement.

NOW, THEREFORE, be it resolved, that the Upper Republican Natural Resources District Board of Directors authorizes Management of the District to meet legal and financial obligations required under the U.S. Bureau of Reclamation's WaterSMART Water and Energy Efficiency Grant Program.



Terry Martin, Chairman



Date Approved